W. H. BENNETT.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED OCT. 14, 1918.

1,413,567.

Patented Apr. 25, 1922.

FIG. 2.

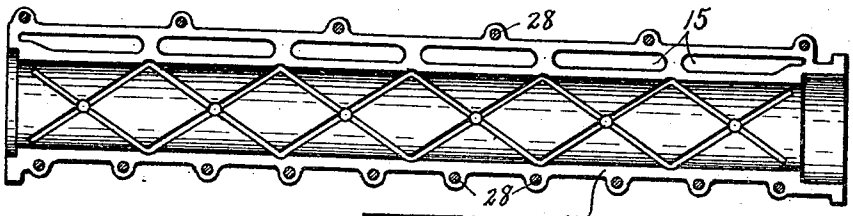


FIG. 1.

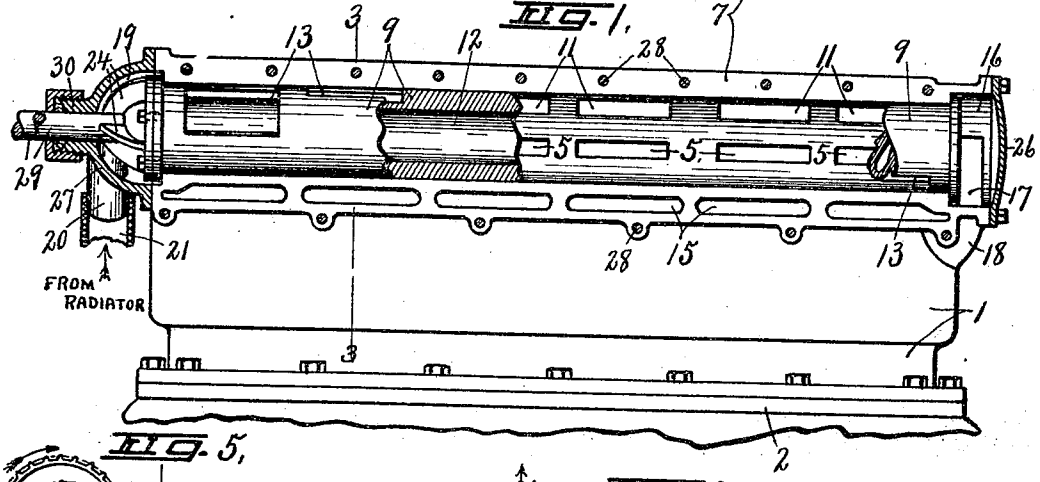
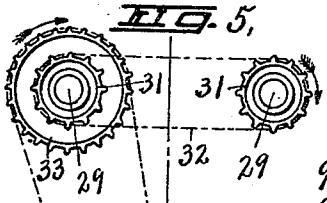


FIG. 5.



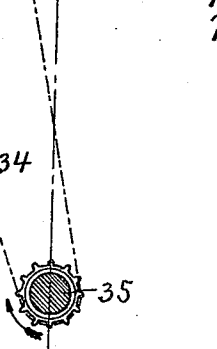


FIG. 3.

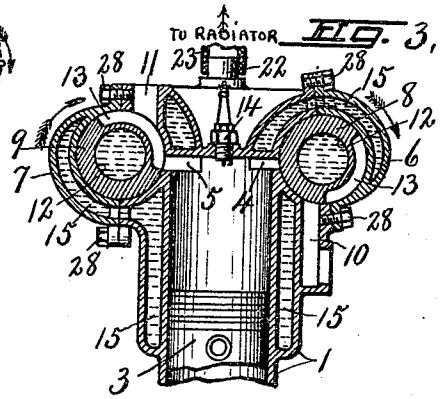
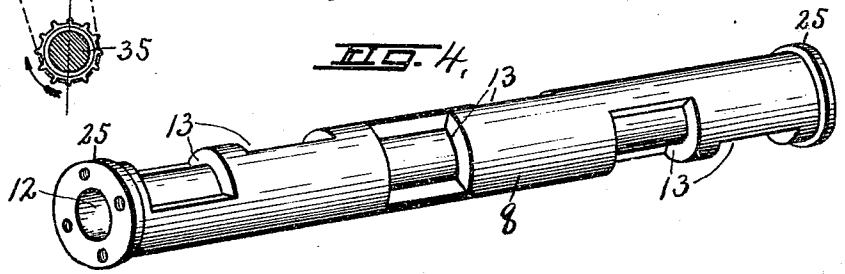


FIG. 4.



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INTERNAL-COMBUSTION ENGINE.

1,413,567. Specification of Letters Patent. Patented Apr. 25, 1922.

Application filed October 14, 1918. Serial No. 258,040.

To all whom it may concern:

Be it known that I, WILLIAM H. BENNETT, a citizen of the United States of America, and resident of Auburn, in the county of Cayuga, in the State of New York, have invented new and useful Improvements in Internal-Combustion Engines, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to certain improvements in internal combustion engines involving the use of rotary valves for controlling the fuel-intake and exhaust to and from the cylinders and refers more particularly to the disposition of the valves relatively to the cylinders and spark-plugs and to the circulatory system for cooling the cylinders and valves.

One of the objects is to arrange the valve-chambers in sufficiently spaced relation to enable them to be water-jacketed throughout the greater portions of their areas in such a manner that the major portions of the jackets will be exposed to atmospheric air for additional cooling purposes and at the same time to maintain communication between said jackets and that which surrounds the cylinders.

Another object is to provide for the circulation of the cooling agent entirely through both of the valves as a part of the same system by which the cooling agent is circulated through the jackets of the valve-casings and cylinders.

A further object is to provide the rotary valves with suitable devices constituting pumps for forcibly circulating the cooling agent through the entire system.

A still further object is to divide the valve casings in such a manner that the outer halves may be removed for inspection or repairs of the corresponding valves and also to permit the casings to be fitted more closely to said valves by the use of suitable shims.

Other objects and uses relating to specific parts of the engine will be brought out in the following description.

In the drawings:

Figure —1— is a side elevation of a six cylinder internal combustion engine embodying various features of my invention, the outer half of one of the valve casings being removed and portions of the adjacent valve being shown partly in section and partly broken away, the lower portion of the crank-case being also broken away.

Figure —2— is an inner face view of the outer half section of the valve case shown in Figure —1—.

Figure —3— is a transverse vertical sectional view taken on line 3—3, Figure —1—.

Figure —4— is a perspective view of one of the rotary valves, the pump therefor being omitted.

Figure —5— is an end view, somewhat diagrammatic, of means for transmitting motion from the crank-shaft of the engine to the rotary valves.

The engine shown comprises a plurality of, in this instance, six cylinders —1— cast enbloc in an upright position and mounted upon a suitable base or crank-case —2— for receiving a corresponding number of reciprocatory pistons —3— which may be connected in the usual manner to any of the standard forms of crank-shafts not shown. Each cylinder is provided near its upper end or top with an inlet-port —4— and an exhaust-port —5— located in diametrically opposite sides thereof, for communication with oppositely disposed valve-casings —6— and —7— which extend across the outer sides of the upper ends of the entire series of cylinders and are therefore common to all of said cylinders, the opposite ends of said chambers being enlarged to form shoulders for engaging annular flanges on the adjacent ends of the valves to hold the latter against endwise movement.

These valve-casings are preferably spaced a sufficient distance apart at opposite sides of the cylinders to enable the greater portions thereof to be exposed to the atmosphere for cooling purposes and are provided with lengthwise circular bores for receiving separate rotary valves —8— and —9—, the valve-case —6— being provided with a series, of in this instance six intake-ports —10—, one for each cylinder while the valve-case —7— is provided with a corresponding number of outlet ports —11—, also one for each cylinder.

The valves —8— and —9— are similar in construction, each being provided with a circular lengthwise opening —12— extending therethrough from end to end, and circumferentially elongated peripheral pockets

—13—, one for each cylinder to register with the corresponding ports as the valve is rotated.

The valves —8— and —9— are connected to rotate in unison in the same direction at half the speed of the crank-shaft, from which motion is imparted thereto by any suitable power-transmitting device, the pockets—13— in said valves being so relatively positioned as to produce the desired opening and closing of the inlet and exhaust ports of each cylinder at the proper time for what is commonly known as a "four-cycle engine."

That is, the relation of each intake pocket —13— to its inlet ports —4— and —10— and also the relation of each exhaust pocket —13— to its ports —5— and —11— of the same cylinder are such as to cause the valve —8— to close the fuel-inlet, and the valve —9— to open the exhaust during the exhaust stroke of the piston —3— from the position shown in Figure —3—, immediately following which or during the next succeeding suction stroke of the piston, the valve —8— will be adjusted to open the fuel-intake while the valve —9— will close the exhaust, whereupon during the next succeeding compression and firing strokes, both valves will have been adjusted to close the intake and exhaust of that cylinder, so that the piston of said cylinder will then be in the first position mentioned or as shown in Figure —3—, ready for a repetition of the operations just described.

The spark-plug, as —14— is preferably secured in the head of the cylinder, midway between the valve casings —6— and —7— so as to bring its terminals in a direct line between the inlet-port —4— and exhaust-port —5—, thus causing the inflowing explosive mixture to impinge directly against the terminals for more speedy and effective ignition and also tending, in a measure to clean and cool said terminals.

The major portions of the walls of the cylinders —1— and valve casings —6— and —7— are hollow to form water jackets —15— communicating with each other to establish a single circulatory system for water or other cooling agents.

The central lengthwise openings —12— through the valves —8— and —9— also form a part of the same circulatory system and for this purpose each communicates at one end (preferably its rear end) with a chamber 16— in the corresponding end of the valve-case, said chamber being connected by a radial opening —17— with a conduit —18— leading to the adjacent end of the water jacket —15—.

The opposite or front end of the opening —12— of each valve communicates with an adjacent chamber —19— in the corresponding end of its valve-case, said chamber being provided with a radial inlet —20— which is adapted to be connected by a flexible pipe —21— to the bottom of a radiator not shown, but in a manner well understood in this art. In order to complete the circulatory system, the central upper portion of the jacket —15— is provided with an outlet —22—, adapted to be connected by a pipe —23— at the top of the radiator.

It is now evident that the cooled water from the bottom of the radiator, is conducted through the pipe —21— and inlet —20— into the chambers —19—, at the front ends of the valve-casings from which chambers it flows through the openings —12— in the valves —8— and —9— into the rear end chamber —16— and thence through the outlets —17— and pipe —18— into the rear end of the water-jacket —15— to completely fill said jacket for taking up the heat from the cylinders and valves, after which the heated water or other cooling agent is conducted through the outlet —22— and pipe —23— back to the top of the radiator in which the heated cooling agent is cooled and the circulation repeated in the manner just described.

It is preferable to provide some means for forcibly circulating this cooling agent rather than to rely wholly upon the automatic siphoning action and for this purpose I have provided the front ends of each of the rotary valves with impeller vanes —24—, arranged in such a manner as to constitute with the adjacent ends of the valves rotary pumps by which the water or other cooling agent is drawn from the bottom of the radiator through the pipe —21— and inlet —20— into the chambers —19— and is then forced through the valves and remaining portions of the circulatory system in the manner previously described.

The opposite ends of each valve are provided with annular flanges —25— adapted to ride against the inner end walls of the chambers —16— and —19— to hold said valves against endwise movement, the outer end walls, as —26— and —27— of each of said chambers being removable to permit access to the adjacent ends of the valves if desired.

Both of the valve-casings —6— and —7— are preferably divided diametrically throughout the entire lengths of the valves, so that the outer halves thereof, as shown more clearly in Figures —2— and —3— may be removed to permit the removal and replacement and adjustment of either valve without disturbing the other valve or its bearing, said removable sections being normally secured in place by bolts —28— which permits the use of thin shims if necessary to produce the desired fit of the valves in their respective chambers.

The front ends of the valves are provided with shafts —29— journaled in suitable stuffing-boxes —30— in the adjacent end

walls of the chambers —19—and are provided with sprockets —31—, connected by a belt —32— for transmitting rotary motion from one valve to the other in the same direction.

One of the shafts is provided with an additional sprocket —33— adapted to be connected by a belt —34— to the crank-shaft, as —35— of the engine, the means for transmitting motion from the crank-shaft to the valves being shown more or less diametrically in Figure —5—.

What I claim is:

In an internal combustion engine, a series of upright cylinders arranged in tandem and provided with separate sets of ports in opposite sides thereof, cylindrical valve chambers extending continuously across both sides of said cylinders and communicating with the adjacent ports and having their opposite ends enlarged, separate rotary valves in said chambers between the enlargements and provided with central lengthwise apertures therethrough connecting the adjacent enlargements for permitting the circulation of a cooling liquid through the valves, means for rotating said valves, and impellers secured to one end of said valves to rotate therewith wholly within the adjacent enlargements of the valve chambers.

In witness whereof I have hereunto set my hand this eighth day of October, 1918.

WILLIAM HENRY BENNETT.

Witnesses:

HERBERT PRICE,

HARRY S. REYNOLDS.